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A NEW LEAF SPOT OF PECAN

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The following report concerns a leaf disease of cultivated pecans that has been under observation in Georgia for two years, and that apparently had not been reported upon prior to the summer of 1927. Inasmuch as the disease has made rapid headway during the past two seasons in establishing itself on some of the cultivated varieties of the state, it was considered worth while to bring the matter to the attention of growers and of other investigators of pecan diseases. Accordingly, in September, 1927, the writer read a paper before the annual convention of the National Pecan Growers Association at Shreveport, Louisiana, on the occurrence of this previously undescribed disease of pecans. The present paper includes a revision of and an enlargement upon the subject matter of the earlier report.

THE DISEASE

History and Distribution

The disease herein concerned, which will be referred to as "yellow leaf-spot," was first observed by the writer in August of 1926, while dusting pecan trees in an orchard near Albany, Georgia, for the control of pecan scab. Little thought was given to the disease at the

time, first because the investigation under way in that test concerned scab control, and secondly, because the spotting at that time appeared to be of no great importance. By early September, however, the disease had become more conspicuous due to the increase in size and number of spots, and was kept under close observation during the remainder of the season.

When trees of all the varieties were examined in the vicinity of that test, the same spotting was observed on Frotcher, Stuart, Schley, and Alley, in addition to the more heavily affected Delmas trees. Delmas represented by far the heaviest and most uniform infection. Stuart and Frotcher trees showed considerable, while only traces could be found on Schley and Alley. At this time, first week in September, the same disease was observed in a second orchard near Baconton, Georgia, where another scab prevention test was being conducted. While the spot was present there in trees of the corresponding varieties, the infection was neither so heavy nor so uniform as in the Albany grove. The disease evidently had not been established as long in this orchard as in the one near Albany.

In 1927, yellow leaf-spot was first observed on July 15th in Lee, Dougherty, and Mitchell counties. At Leesburg and Dewitt, it was as prominent on Delmas as it was on the same variety a month earlier in 1926. Stuart and Frotcher trees were lightly affected, while only a mere trace was evident on Schley and Alley. This year, the disease has been found in the following counties: Lee, Dougherty, Mitchell, Thomas, Grady, Brooks, Tift, Worth and Coffee—in fact, on Delmas, Stuart, Frotcher and moneymaker in every pecan growing section of the southern part of the state. The middle and nothern sections of the state have not been surveyed for the presence of the disease. Although the new spot is, in all probability, of recent introduction on the pecan, yet there is little doubt but that it has been gaining a foothold in such varieties as Delmas, Stuart, Frotcher and

Moneymaker for several years, and has merely been overlooked.

VARIETAL SUSCEPTIBILITY

Although this disease is apparently just now adapting itself to the cultivated varieties of pecan, there is evidence of marked difference in susceptibility of the varieties affected. It was perhaps the high degree of susceptibility of the Delmas variety that first attracted the attention to the presence of the disease last year. At the time the spotting was first noticed, in August, at least 90 per cent of the leaflets were affected, with few too many lesions to the leaflet. By the latter part of September, the spots had so increased in number and size to impart a general bronze color to the foliage. Nearby trees of the Stuart and Frotcher varieties showed only moderate infection, while trees of Alley and Schley varieties exhibited only a trace of infection. The spots on the Stuart and Frotcher leaves, although numerous, were neither so large nor so deeply necrotic as those on the Delmas leaves.

In 1927, three additional varieties were observed affected with yellow leaf-spot, Moneymaker, Van Deman, and Mobile. The varieties found affected up to the present time are as follows, arranged in the order of their relative susceptibility: Delmas, Moneymaker, Stuart, Frotcher, Van Deman, Schley, Alley, and Mobile. Common varieties observed not attacked are Moore, Success, Tesch, and Pabst.

It has been observed that the prevalence of varieties in a given orchard may influence the severity of infection in trees of the different varieties. For example, in 1927 the infection in Frotcher trees of a 50 acre orchard in Thomas county consisting largely of the Frotcher variety, was decidedly heavier than that on ether the Moneymaker or Stuart variety. In the last two named varieties, the degree of infection was about equal. In a second large orchard of the same age and

in the same county, on the other hand, in which the Moneymaker variety predominated, that variety was noticeably more heavily attacked than either the Frotcher or Stuart. In a third orchard in a different county, an extensive planting of Delmas trees presented an unusually severe infection of yellow spot, while a few scattered Moneymaker trees and a large block of Alleys showed only a trace of the disease. Delmas trees, in whatever orchard surveyed, showed the heaviest degree of infection of all varieties present.

The disease under consideration has been found in only a few of the many pecan nurseries surveyed, and it exhibited there about the same variation in host preference as occur in orchards with more or less equally populated varieties.

ECONOMIC IMPORTANCE

This leaf-spot disease of pecans is probably of too recent introduction, with very uniform distribution, to justify an estimate of its economic importance. Nevertheless, in 1926 one orchard of 12-year old Delmas trees underwent defoliation at least two weeks prematurely, and no doubt suffered considerable impairment of leaf function from the first of August to the first part of October. In 1927, the same condition was observed in the same orchard and in additional ones on the Delmas variety. Also, several plantings of Moneymaker, Frotcher, and Stuart were sufficiently heavily attacked to experience slight premature defoliation, with appreciable impairment of leaf function during July, August, and September.

Although the Delmas variety is at present the most susceptible one to yellow leaf-spot, it does not possess as much commercial value as the other varieties mentioned, due to its extreme susceptibility to the scab disease. Should the disease, however, continue to establish itself on the other varieties at the rate it has during

the past two years, it may prove to be a limiting factor in nut production.

SYMPTOMS

The first indication of the presence of yellow leaf-spot on relatively young, tender leaves, especially in nursery stock, is the appearance on the underside of the leaflets of a small, white, mildew-like spot (Figure 1, b) usually irregular in outline. The downy or mildew-like coating consists of an abundance of conidia and conidiophores. At this stage, there occurs only a slight yellowish discoloration of the leaf tissue at the infected area on the underside, with no evidence of the presence of a lesion on the upper side. On older leaves, the prominent "frosty" or mildew-like stage may not at all occur, even when the lesion is relatively young. In such a case, the first evidence of the disease is merely a pale yellow, or yellowish-red lesion on the underside of the leaf. In this event, sporulation is comparatively light.

As infection ages, the lesion increases in size, becomes yellowish-brown in color with a more or less definite margin (Figure 1, a). It loses its frosty appearance due to the dissemination and disintegration of the conidia. The lesion becomes discernible on the upper side of the leaf as the infection progresses through the leaflet, reaching the upper epidermis. In the more susceptible varieties, the spots if only sparing in number may assume a diameter of a quarter of an inch. Where the spots are more numerous, however, they usually remain smaller with an irregular margin. In the Delmas variety and occasionally in Frotcher, the late stage of the disease may appear as dark brown spots on the underside of the leaflet with a brown to black color on the upper side. In the lesser susceptible varieties, the lesion is evident on the underside of the leaf for a comparatively longer time before it appears on the upper side than in the case of the two varieties mentioned above. Even in such varieties as Delmas, Frotcher, and Mon-

eymaker, sporulation may occur for some time before the cells in the upper part of the lesion are killed by the invading mycelium.

Sporulation, as a rule, takes place only while the lesion is relatively young, or perhaps later following wet weather. It has not, however, been observed to occur after the leaf tissue in the lesion has been wholly killed. Neither has sporulation been observed on the upper side of the spot.

THE CAUSAL ORGANISM

The taxonomy of the fungus causing yellow leaf-spot of pecans is not definitely settled. The fungus, with very short, hyaline conidiophores breaking through the leaf in from one to many ascervuli, and bearing in profusion one to many septated elongated, hyaline, conidia, resembles both Cylindrosporium and Cercosporella, and yet is not typical of either genus. The writer recognized this probable generic relationship of the organism in the paper read before the National Pecan Growers Association in September of this year. Soon thereafter, Demaree and Cole (plant disease reporter Vol. 11, No. 11, 1927) who observed the disease for the first time in the summer of 1927, and who also are studying the fungus from a taxanomic standpoint, consider the organism identical with **Cylindrosporium caryigenum** Ell. & Ev., described as causing a leaf spot on **Carya amara (Hicora minima)**, and collected in Canada in 1899. Further study is now under way bearing on the classification and life history of the fungus.

NAME OF THE DISEASE

The name, "yellow leaf-spot," has been temporarily assigned to this disease of the pecan because, at present, it seems to be more indicative than any other. The names "frosty mildew" 'and "brown-spot" are also descriptive of the disease in some of its stages of development. As

the "frosty" stage, however, may not at all be present, and as the name "brown spot," is already in use to designate a Cerospora leaf-spot of pecans, the name that has been chosen might be preferred. It, at least, is descriptive of the lesion through a greater part of its development. When the identity of the causal organism is definitely established, the disease might better be designated by the generic relationship of the fungus; i. g., the "'Cylindrosporium leaf-spot," or the "Cercosporella leaf-spot of pecans.

CONTROL

Although no experiments have been conducted solely for the control of yellow leaf-spot of pecans, there were occasions in both 1926 and 1927, in scab control tests, for ascertaining the value of sulphur and copper dusts and of Bordeaux mixture spray in preventing the development of the disease. While the disease was present each year on three varieties, namely, Delmas, Schley and Alley, in two different scab control experiments, the infection was sufficiently heavy and uniform on only the Delmas variety to furnish an estimate of the degrees of control in the protected trees. When the disease was observed for the first time, in August, 1926, the Delmas trees that had received seven applications of a 20-80 copper-lime dust showed perhaps less than one-fourth as many spots per leaflet as the nearby untreated trees. The trees that received the same number of applications of a sulphur dust showed about twice as much infection as those dusted with the copper dust. As the season progressed, the infection in the untreated trees increased until early October when the leaves assumed a bronze color due to the merging of the numerous spots on the leaflets. Those leaves turned brown and fell at least two weeks earlier than the leaves on trees dusted with the copper dust.

In 1927, in a scab control experiment at Putney, Georgia, infection in Delmas trees that received five applica-

tions of a copper-lime dust, was reduced to about 20 per cent of that in the controls. In an experiment at Baconton, six applications of the same dust and four of Bordeaux mixture, 3-6-50, reduced the infection on Delmas to about 15 per cent to 20 per cent of that on the untreated trees.

The outstanding point observed in the control of this disease, was the failure to obtain the high degree of protection that results in the use of the same protective materials against scab, and against another leaf-spot that develops during the same time of year as does the yellow leaf-spot, i. e., the Cercospora leaf blotch of pecans. In some instances where Delmas trees received the full scab prevention program of either dust or spray, leaves that were considered well covered throughout the season showed anywhere from one to dozens of spots per leaflet. If the disease continues to adapt itself rapidly to the pecan varieties, such non-scabbing, or light-scabbing, varieties as Frotcher, Stuart, and Moneymaker may soon fall into the list of those requiring protective fungicides.